Associations amongst sedentary and active behaviours, energy expenditure, body fat and appetite dysregulation

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Associations amongst sedentary and active behaviours, body fat and appetite dysregulation

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ACEB Appetite Control & Energy Balance RESEARCH

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Background

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WHAT IS SEDENTARY BEHAVIOUR?

- Any waking behaviour characterized by an energy expenditure ≤1.5 METs whilst in a sitting or reclining posture (Sedentary Behaviour Research Council, 2012)

- We are more sedentary than ever!
  - Recent report suggests limiting work place sitting by increasing standing by 2 – 4 hours/day (Buckley et al. 2015)

- Sedentary behaviour has been linked to a number of negative health outcomes including all-cause mortality, cardiovascular disease, type II diabetes and metabolic syndrome (Rezende et al. 2014)

- Moreover, these deleterious health effects have been shown to be independent of moderate-to-vigorous physical activity (MVPA) (Biswas et al. 2015)

- Less is known about the relationship between objectively measured **sedentary behaviour** and **appetite control**

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Linking energy intake with energy expenditure

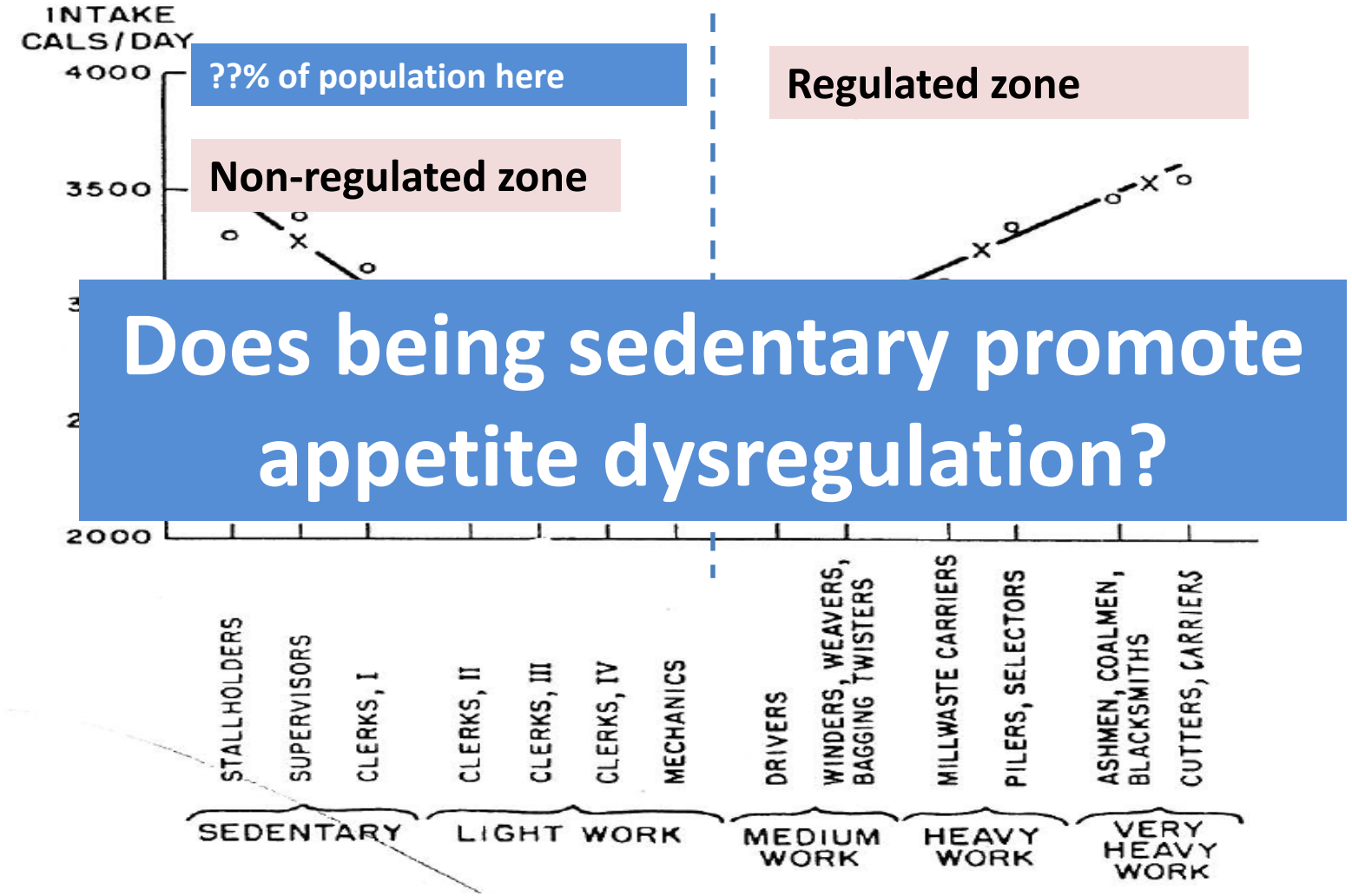
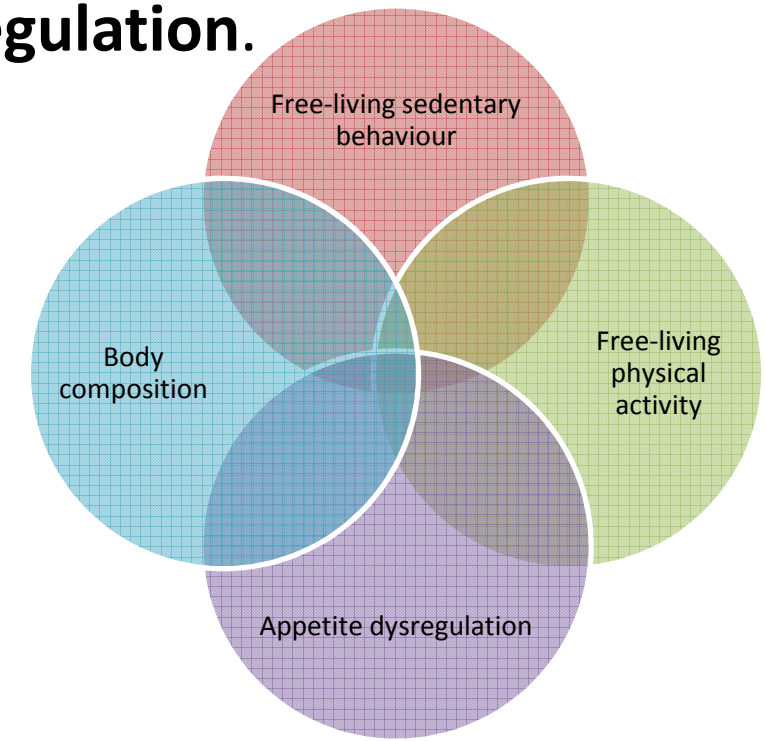


Figure 1. At moderate and high levels of physical activity energy intake matches energy expenditure; however at lower levels of physical activity EI exceeds energy expenditure creating a positive energy balance (Blundell, 2011 adapted from Mayer et al. 1956).

Is sedentariness associated with body composition and dysregulated appetite control?

- The objective of this study was to investigate whether objectively measured **free-living PA** and **sedentary behaviour** were associated with **body composition** and **appetite dysregulation**.



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Methods

Appetite Dysregulation

- **Eating Behaviour Traits measuring disinhibition, restraint, hunger (TFEQ); binge eating (BES)**

Body Composition

- **Bodpod**
  Body weight, fat mass, fat free mass, % body fat
- **Waist Circumference and BMI**

Free-living PA

- **SenseWear Armband (1 week)**

Cardiovascular Fitness

- Indirect Calorimetry
  Measures maximal amount of O_2 consumption

Heart Rate and Blood Pressure

- Omron System
  Resting heart rate and blood pressure

Resting Metabolic Rate

- Indirect Calorimetry

Fasting Glucose

- Finger prick samples measured using YSI machine

Free-living PA

- activPAL (1 week)

Measures on day 1

Measures on day 8

7 days continuous measurement of free-living physical activity

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Free-living physical activity and sedentary behaviour

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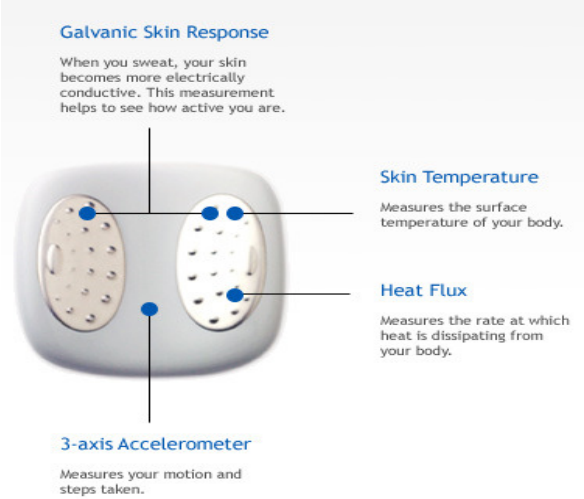
- SenseWear armband Mini (BodyMedia, Pittsburgh, PA): Triaxial accelerometer; Galvanic skin response; skin temperature; heat flux



- Armband worn on non-dominant arm half way between the elbow and the shoulder

- 6-7 days continuous wear including 2 weekend days
  - Classification of a full day: ≥22 hours wear time

- Proprietary algorithms calculate intensity of activity in METs

	Sedentary	Light	Moderate	Vigorous
Intensity (METs)	<1.5	1.5-2.9	3-5.9	>6

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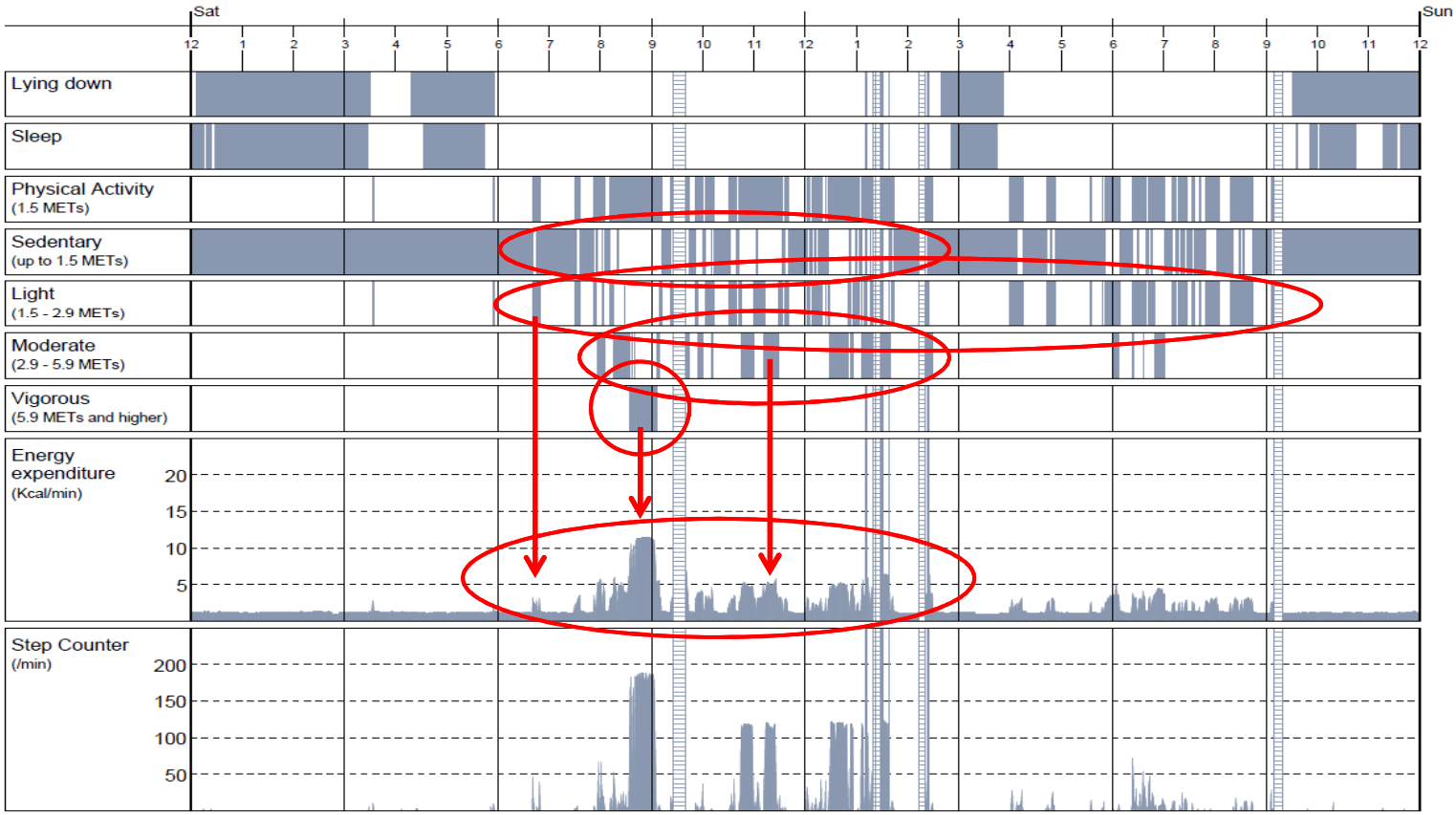
Free-living physical activity and sedentary behaviour profile

Subject	Age	Gender	Weight	Height	Handed	Smoker	BMI
	71	Male	73.9 kg	175 cm	Right	No	24.13

Start Time	End Time	Duration of View	Duration on-body
Sat 17 May 2014 00:00	Sun 18 May 2014 00:00	1 day	23 hrs 15 min (96.9%)



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RESULTS

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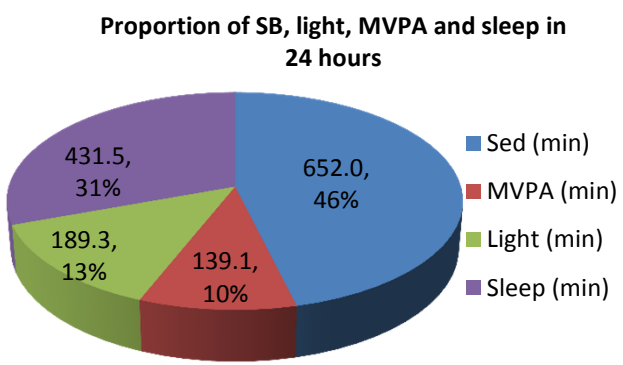
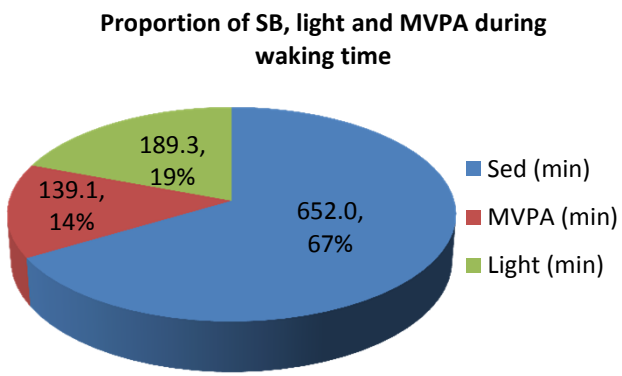
Results 1 – Physical activity and sedentary behaviour

- 58 participants (13 males, 45 females) age 37.0 ± 13.8 years, BMI 28.6 ± 4.9 kg/m^2
- 96.4% (n55) compliance (≥6 days, ≥22 hours/day)

	Minimum	Maximum	Mean	Std. Deviation
Sedentary behaviour (min/day)	360.7	924.0	652.0	104.0
Light PA (min/day)	81.0	327.0	189.4	58.1
Moderate PA (min/day)	30.0	368.5	129.9	78.4
Vigorous PA (min/day)	0.0	47.7	9.2	11.4
Total PA (min/day)	123.9	635.9	328.4	100.4
MVPA (min/day)	31.1	404.2	139.1	86.0

~11 hours! 67% of the waking day



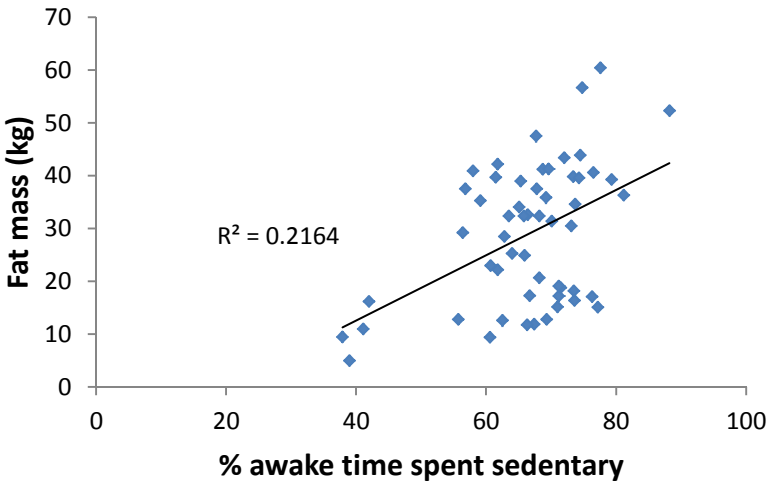


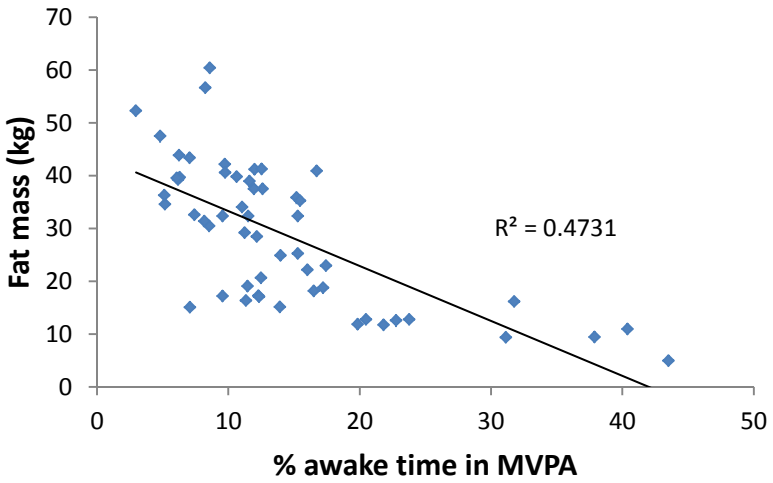
Results 2 – Body composition

- Sedentary behaviour was positively associated and MVPA negatively associated with multiple indices of adiposity

	Body mass	BMI	Fat mass	% fat mass	WC
Sedentary behaviour	0.40†	0.47†	0.47†	0.44†	0.44†
MVPA	-0.52†	-0.69†	-0.69†	-0.71†	-0.63†

n=55; data are Pearson correlations (r). *p<0.05; †p<0.01. Waist circumference (WC).





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Results 3 – Body composition

- After controlling for MVPA the correlations between sedentary behaviour and adiposity were no longer significant
- However, when the correlations between MVPA and adiposity were adjusted for sedentary behaviour they remained significant
- This suggests that the absence of MVPA could be more important than the presence of sedentary behaviour in the accumulation of fat mass

	Body mass	BMI	Fat mass	% fat mass	WC
Sedentary behaviour[1]	-0.04	-0.22	-0.24	-0.35†	-0.16
MVPA[2]	-0.37†	**-0.61†**	**-0.60†**	**-0.68†**	**-0.52†**

n=55; data are Pearson correlations (r). [1] controlled for MVPA in minutes; [2] controlled for sedentary time in minutes.
*p<0.05; †p<0.01. Waist circumference (WC).

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Results 4 – Eating behaviour traits

- There was no association between sedentary behaviour and appetite dysregulation
- MVPA was associated with TFEQ Disinhibition and Binge Eating
- But these relationships were no longer significant when controlling for adiposity

	Unadjusted		Adjusted for % fat mass	
	SB	**MVPA**	**SB[1]**	**MVPA[1]**
Disinhibition	0.22	-0.52†	-0.14	-0.12
Binge eating	0.17	-0.38†	-0.18	-0.08

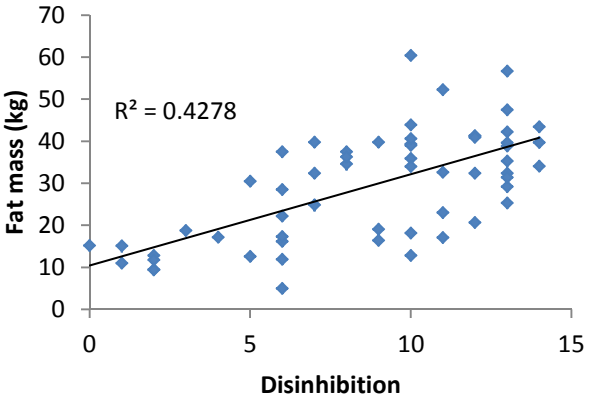
n=58; data are Pearson correlations (r). [1] controlled for % fat mass (n=55). †p<0.01.
Waist circumference (WC); SB (sedentary behaviour); energy expenditure (EE).

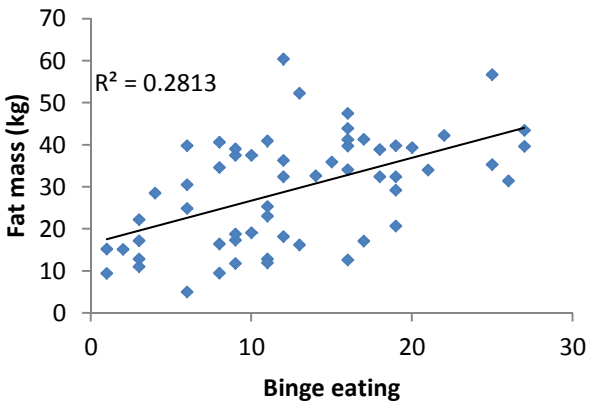
Results 5 – Eating behaviour traits

- Higher levels of adiposity were associated with higher levels of TFEQ Disinhibition and Binge Eating

	Lean mass	Fat mass	% fat mass	WC	SB[1]	MVPA[1]
Disinhibition	-0.11	0.65†	0.65†	0.61†	-0.14	-0.12
Binge eating	-0.03	0.53†	0.49†	0.52†	-0.18	-0.08

n=58; data are Pearson correlations (r). [1] controlled for % fat mass (n=55). †p<0.01. Waist circumference (WC); SB (sedentary behaviour); energy expenditure (EE).





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Summary

- Sedentary time was associated with higher adiposity – **NOT independent of MVPA**
- MVPA was associated with lower adiposity – **WAS independent of sedentary behaviour**
- After controlling for adiposity sedentary behaviour and MVPA were **NOT** associated with appetite dysregulation
- Adiposity **WAS** positively associated with Disinhibition and Binge Eating
- The influence of sedentary behaviour and MVPA on appetite dysregulation may **not** be direct, but could be indirectly influencing appetite via fat mass accumulation over time

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Thank you for listening